

1                    SYSTEM AND METHOD FOR GENERATING

2                    HIGH-LUMINANCE WINDOWS ON A COMPUTER DISPLAY DEVICE

3  
4                    BACKGROUND OF THE INVENTION

5        1.    Field of the Invention

6            This invention relates generally to computer displays and more  
7 particularly to a system and method for generating high-luminance  
8 windows on a computer display device.

9  
10       2.    Description of the Background Art

11           Optimal and effective presentation of visual information is a  
12 significant consideration of manufacturers, designers and users of  
13 computer display monitors. The use of computer displays for conveying  
14 various types of visual information is also becoming more important as  
15 computer system functionality increases. For example, a computer  
16 application may advantageously insert a separate viewing area or  
17 window onto a computer display screen. The window area may then  
18 display selected viewing information that is different from the viewing  
19 information presented on the display screen outside the window area.  
20 One such implementation displays video information from a video

1 source (such as a video tape recorder) in the window area and  
2 simultaneously displays computer generated information (such as text  
3 or graphics) on the display screen outside the window area.

4 Referring now to FIG. 1, a diagram of a display 110 is shown. The  
5 display 110 includes a screen 112 that displays various types of  
6 viewing information to a system user. Display 110 includes a viewing  
7 window 114 which may be selectively sized and positioned on screen  
8 112. A host computer system (not shown) may then advantageously  
9 insert selected video images within the video window 114 for viewing  
10 while the neighboring text and/or graphic information is simultaneously  
11 displayed on the remaining areas of screen 112.

12 In conventional computer displays that are not specifically  
13 designed for displaying video information, luminance levels are  
14 typically somewhat lower than the luminance levels used in  
15 conventional video displays. These lower luminance levels result in a  
16 relatively lower contrast ratio between dark and light areas of  
17 displayed information. In practice, window 114 is typically displayed  
18 at the same relative luminance levels as much of the surrounding  
19 screen 112 on display 110. However, lower luminance levels tend to  
20 produce video pictures which appear somewhat drab and washed-out.

1 Conversely, higher luminance levels tend to bring out more detail in the  
2 displayed information and thus cause moving video images to appear  
3 more vivid and interesting to the viewer.

4 In operation, luminance levels are proportional to the amount of  
5 beam current generated in display 110. Higher luminance levels  
6 typically require greater beam current values. These increased beam  
7 currents, however, adversely affect the resolution of displayed  
8 information by increasing the spot size of the electron beam as it strikes  
9 phosphors lining the inner surface of screen 112. The increased spot  
10 size may result in a blurring of text or graphic information displayed on  
11 screen 112. Increasing beam current also may cause the cathode ray  
12 tube (CRT) of display 110 to unacceptably age at a faster degradation  
13 rate. Finally, the production of a higher beam current requires display  
14 110 to dissipate a greater amount of power and therefore necessitates a  
15 heavier and more costly chassis when manufacturing display 110.

16 The foregoing factors (which are caused by increasing the  
17 luminance levels over the entire surface of screen 112) are undesirable  
18 in the design and manufacture of computer display monitors.  
19 Therefore, an improved system and method for generating high-

- 1 luminance windows on a computer display device is needed, in
- 2 accordance with the present invention.

08900964.072657



1       The window generator receives the window control signals and  
2       responsively generates and provides a window pulse to the ABL. The  
3       generated window pulse provides information about the size and  
4       position of the high-luminance windows on the viewing screen of the  
5       CRT. The ABL receives the window pulse and responsively generates  
6       and provides an analog window signal to the gain control of the video  
7       amplifier. The analog window signal thus increases the luminance of  
8       the amplified video signal during the period of the high-luminance  
9       window by increasing the gain of the video amplifier during the  
10      appropriate time period.

11       To prolong the life span of the computer display, the ABL also  
12      advantageously limits the average beam current provided to the CRT  
13      during the period of high-luminance window. In practice, the ABL  
14      samples beam current supplied by the HVPS. If the sampled beam  
15      current from the HVPS exceeds a preset threshold value, then the gain  
16      of the video amplifier is limited by adjusting the analog window signal.  
17      The present invention thus provides a video window with a higher  
18      luminance level than the remainder of the information displayed on the  
19      screen of the computer display and is therefore able to advantageously  
20      generate high-luminance windows on the computer display device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram of a computer display having a window area positioned on the viewing screen of the computer display;

FIG. 2 is a block diagram of a preferred computer system including a computer display;

FIG. 3 is a block diagram of the display of FIG. 2, according to the present invention;

FIG. 4(a) is a drawing of a video waveform illustrating relative video levels including a conventional window area;

FIG. 4(b) is a drawing of a video waveform illustrating relative video levels including a window area in accordance with the present invention;

FIG. 5 is a block diagram of the preferred embodiment for the window generator of FIG. 3;

1

2       FIG. 6 is a block diagram showing the communication of control  
3 information according to the present invention;

4

5       FIG. 7 is a schematic diagram of the preferred embodiment for the  
6 video amplifier and automatic beam limiter of FIG. 3; and

7

8       FIG. 8 is a drawing of a waveform for the analog window signal  
9 illustrating the effect of automatic beam limiting.

08900964-072597



1           DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

2           The present invention relates to an improvement in display  
3 devices, including computer displays. The following description is  
4 presented to enable one of ordinary skill in the art to make and use  
5 the invention and is provided in the context of a patent application  
6 and its requirements. Various modifications to the preferred  
7 embodiment will be readily apparent to those skilled in the art and  
8 the generic principles herein may be applied to other embodiments.  
9 Thus, the present invention is not intended to be limited to the  
10 embodiment shown but is to be accorded the widest scope consistent  
11 with the principles and features described herein.

12           The present invention comprises a system and method for  
13 generating high-luminance windows on a computer display device and  
14 includes a video amplifier which provides video signals to a cathode ray  
15 tube, a window generator which provides a window signal to the video  
16 amplifier to generate the high-luminance window and an automatic  
17 beam limiter which controls the beam current provided to the cathode  
18 ray tube, in accordance with the present invention.

19

26922014900680

1 Referring now to FIG. 2, a block diagram of a computer 210 is  
2 shown, in accordance with the present invention. Computer 210  
3 preferably comprises a central processing unit (CPU) 212, a video  
4 display 110, a keyboard 216, an input device 218 and a memory 224.  
5 Each element of computer 210 is preferably coupled to a common  
6 system bus 226. Memory 224 may alternatively comprise various  
7 storage-device configurations, including Random-Access-Memory  
8 (RAM), Read-Only-Memory (ROM) and non-volatile storage devices such  
9 as floppy disks. In the preferred embodiment, memory 224 includes at  
10 least one application 228 and an operating system 230.

11  
12 Referring now to FIG. 3, a block diagram of the preferred  
13 embodiment for display 110 (FIG. 2) is shown, according to the present  
14 invention. Display 110 preferably includes a video amplifier 318, a  
15 window generator 326, a high-voltage power supply (HVPS) 320, an  
16 automatic beam limiter (ABL) 332 and a cathode-ray tube (CRT) 322.

17 In the preferred embodiment of the present invention, video  
18 amplifier 318 receives a video signal via line 310. The video signal  
19 includes information for presentation on display 110 and is typically  
20 provided by CPU 212 via system bus 226. Video amplifier 318

1 responsively amplifies the received video signal and then applies the  
2 amplified video signal to the cathode of CRT 322 via line 319. HVPS  
3 320 provides a high-voltage signal to the anode of CRT 322 via line 324.  
4 CRT 322 responsively generates and provides an electron beam which  
5 strikes phosphors located on the inner surface of the viewing screen in  
6 CRT 322. In practice, video amplifier 318 includes three separate color  
7 channels (red, blue and green) which generate three separate electron  
8 beams in CRT 322, however, for simplicity, the following discussion will  
9 reference a single electron beam and corresponding beam current.

10 In the preferred embodiment, CPU 212 also provides a horizontal  
11 synchronization (H Sync) signal, a vertical synchronization (V Sync)  
12 signal and window control signals to display 110 via system bus 126. H  
13 sync is then provided, via line 312, to HVPS 320 and to window  
14 generator 326 via line 328. V sync is provided via line 314 to <sup>window</sup>~~widow~~  
15 generator 326 and the window control signals are also provided, via line  
16 316, to window generator 326.

17 The window control signals on line 316 advantageously gate the  
18 generation of a high-luminance window on display 110, in accordance  
19 with the present invention. In the preferred embodiment, a window  
20 request is sent by the host computer operating system 230 or by an

269220-49500680

1 application 228 whenever it is desirable to generate a high-luminance  
2 window. In another embodiment, the window request may be relayed  
3 through a serial communications channel (such as the Video Electronics  
4 Standards Association DDC2AB or the Universal Serial Bus) from a host  
5 computer 210 to a separately-enclosed display 110. The window  
6 request causes CPU 212 to provide the window control signals on line  
7 316. The window control signals then enable window generator 326,  
8 which, in turn, initiates the process of generating a high-luminance  
9 window on display 110.

10 The window generator 326 receives the H sync signal on line 312,  
11 the V sync signal on line 314 and the window control signals on line  
12 316, and responsively generates and provides a window pulse to ABL  
13 332 via line 330. The generated window pulse provides information  
14 about the size and position of window 114 on the viewing screen of CRT  
15 322. Window generator 326 is further discussed below in conjunction  
16 with FIG. 5.

17 ABL 332 receives the window pulse on line 330 and responsively  
18 generates and provides an analog window signal (on line 336) to the  
19 gain control of video amplifier 318. Analog window signal on line 336  
20 thus increases the luminance of the amplified video signal during the

1 period of window 114 by increasing the gain of video amplifier 318  
2 during the appropriate time period. To prolong the life span of display  
3 110, ABL 332 also advantageously limits the average beam current  
4 provided to CRT 322 during the period of high-luminance window 114.  
5 In practice, ABL 332 samples HVPS 320 on line 334 and, if HVPS 320  
6 exceeds a preset threshold value, then the gain of video amplifier 318 is  
7 limited by adjusting the analog window signal on line 336. The present  
8 invention thus provides a video window with a higher luminance level  
9 than the remainder of the information displayed on screen 112 of  
10 display 110.

Referring now to FIG. 4A, a drawing of a video waveform 410 including a conventional window area is shown. Referring also to FIG. 4B, a drawing of a video waveform 420 including a high-luminance window area is shown, in accordance with the present invention. In FIG. 4A, the conventional window area is shown on video waveform 410 between times 416 and 418. Waveform 410 also shows a positive-going black level 412 (which represents minimum luminance) and a negative-going peak white level 414 (which represents maximum luminance).

20100304 14:46:00

1 In waveform 420 of FIG. 4B, the high-luminance window area is  
2 shown between times 416 and 418. As in FIG. 4A, a positive-going  
3 black level 412 and a negative-going peak white level 414 are shown in  
4 FIG. 4B. However, in accordance with the present invention, the video  
5 waveform 420 also contains video information extending negatively  
6 beyond peak white level 414 to reach a super peak white level 422  
7 between times 416 and 418 (in the high-luminance window area). The  
8 super peak white level 422 thus represents the area of increased  
9 luminance provided in the high-luminance window of the present  
10 invention.

11  
12 Referring now to FIG. 5, a block diagram of the preferred  
13 embodiment for window generator 326 (FIG. 3) is shown. Window  
14 generator 326 preferably includes a vertical delay or line counter  
15 (vertical delay) 516, a horizontal delay 510, a vertical window pulse  
16 generator 518, a horizontal window pulse generator 512 and a three-  
17 input AND gate 514.

18 In practice, window generator 326 uses vertical delay 516 and  
19 vertical window pulse generator 518 to provide the vertical position  
20 and vertical size of the window area represented by the window pulse

1 on line 330. Furthermore, window generator 326 uses horizontal delay  
2 510 and horizontal window pulse generator 512 to provide the  
3 horizontal position and horizontal size of the window area represented  
4 by the window pulse on line 330.

5 In one embodiment, vertical delay 516 receives a control signal  
6 520 from CPU 212 to indicate the vertical starting location of the  
7 window area represented by the window pulse on line 330. Vertical  
8 window pulse generator 518 then receives a control signal 522 from  
9 CPU 212 to indicate the vertical ending location of the window area  
10 represented by the window pulse on line 330. Furthermore, horizontal  
11 delay 510 receives a control signal 524 from CPU 212 to indicate the  
12 horizontal starting location of the window area represented by the  
13 window pulse on line 330. Horizontal window pulse generator 512 then  
14 receives a control signal 526 from CPU 212 to indicate the horizontal  
15 ending location of the window area represented by the window pulse on  
16 line 330.

17 Vertical delay 516 and vertical window pulse generator 518 thus  
18 generate a vertical component of the window pulse on line 330 and  
19 provide the vertical component to a first input of AND gate 514.  
20 Further, horizontal delay 510 and horizontal window pulse generator

1 512 generate a horizontal component of the window pulse on line 330  
2 and provide the horizontal component to a second input of AND gate  
3 514. A third input of AND gate 514 preferably receives a window  
4 enable control signal via line 316. When the window enable signal is  
5 held to an "active" or "enabled" state, then window generator 326  
6 advantageously generates the window pulse on line 330, in accordance  
7 with the present invention.

8  
9 Referring now to FIG. 6, a block diagram of one embodiment for  
10 the communication path of window control information is shown, in  
11 accordance with the present invention. The FIG. 6 communication path  
12 preferably includes an application program 228, an operating system  
13 230, a video generator 610, a data output port 612, a video amp 318  
14 and a cathode ray tube (CRT) 322. In this embodiment, the application  
15 program 228 is a movie player application which typically sends control  
16 signals and video signals to operating system 230. Operating system  
17 230 responsively provides the control signals to data output port 612  
18 and provides the video signals to video generator 610.

19 Video generator 610 then processes the video signals and  
20 provides the processed video signals to video amplifier 318 in display



1 110. Data output port 612 provides the control signals to the beam  
2 current control system of the present invention which advantageously  
3 controls the gain of video amplifier 318. CRT 322 then receives the  
4 amplified video signals from video amplifier 318, including the high-  
5 luminance window area provided in accordance with the present  
6 invention.

7  
8 Referring now to FIG. 7, a schematic diagram of one embodiment  
9 for video amplifier 318 and ABL 332 (FIG. 3) is shown. In the FIG. 7  
10 embodiment, preamplifier 718 of video amplifier 318 receives a video  
11 signal on line 310 and responsively amplifies and passes the video  
12 signal through transistor 722 and transistor 728 to generate and  
13 provide an amplified video signal to the cathode of CRT 322 via line  
14 319.

15 Video amplifier 318 preferably operates in either a normal-gain  
16 mode or a high-gain mode. Switching between the normal-gain mode  
17 and the high-gain mode is controlled by the state of the analog window  
18 signal applied to the gain control of video amplifier 318 via line 336.  
19 When the respective bases of transistor 734 and transistor 736 are  
20 maintained at the same relative voltage level, then video amplifier 318

1 operates in normal-gain mode, however, when the analog window signal  
2 is applied from ABL 332 to the base of transistor 736, then video  
3 amplifier 318 operates in high-gain mode.

4 To generate the analog window signal on line 336, ABL 332  
5 receives a window pulse on line 330 and responsively passes the  
6 window pulse through transistor 776 to line 336. To limit the beam  
7 current in CRT 322 during the high-luminance <sup>window</sup>~~video~~, ABL 322 controls  
8 the amplitude of the analog window signal on 336. In practice, ABL 332  
9 samples the output current of flyback transformer 750 (of HVPS 320)  
10 on line 334 and compares the sampled high-voltage output to a preset  
11 threshold. If the threshold is exceeded, then transistor 758 adjusts the  
12 output of transistor 776 on line 336 (analog <sup>window</sup>~~video~~ signal) to effectively  
13 limit the beam current in CRT 322.

14  
15 Referring now to FIG. 8, a drawing of an analog window signal  
16 waveform 810 is shown, in accordance with the present invention.  
17 Waveform 810 shows the analog window signal occurring between  
18 times 812 and 814. In the FIG. 8 waveform 810, an amplitude 816 is  
19 shown for a state in display 110 where ABL 332 is not actively limiting  
20 beam current in CRT 322. Additionally, an reduced amplitude 818 is

1 shown for a state in display 110 where ABL 332 is actively limiting  
2 beam current in CRT 322.

3 Since the high-luminance window may potentially be large (in  
4 some cases nearly as large as the entire screen 112 of CRT 110) it is  
5 desirable to automatically limit the average beam current by controlling  
6 the video signal gain within the high-luminance window. Although  
7 peak luminance in the video window can be 3 to 5 or more times the  
8 peak luminance of the rest of the display without increasing the power  
9 handling capabilities of the chassis, luminance that exceeds these levels  
10 can negatively impact CRT phosphor aging. Using ABL 332 to limit  
11 beam current during the window period will prevent these undesirably  
12 high levels of luminance. Additionally, since ABL 332 only changes the  
13 video signal in the window, the system user will have an improved  
14 perception of display 110 performance based on smaller spot size and  
15 clarity of text/graphics outside the high-luminance window.

16 The invention has been explained above with reference to a  
17 preferred embodiment. Other embodiments will be apparent to those  
18 skilled in the art in light of this disclosure. For example, the present  
19 invention may readily be implemented using hardware and/or software  
20 configurations other than those described in the preferred embodiment

1 above. Additionally, the present invention may effectively be used in  
2 conjunction with systems other than the one described above as the  
3 preferred embodiment. Therefore, these and other variations upon the  
4 preferred embodiments are intended to be covered by the present  
5 invention, which is limited only by the appended claims.